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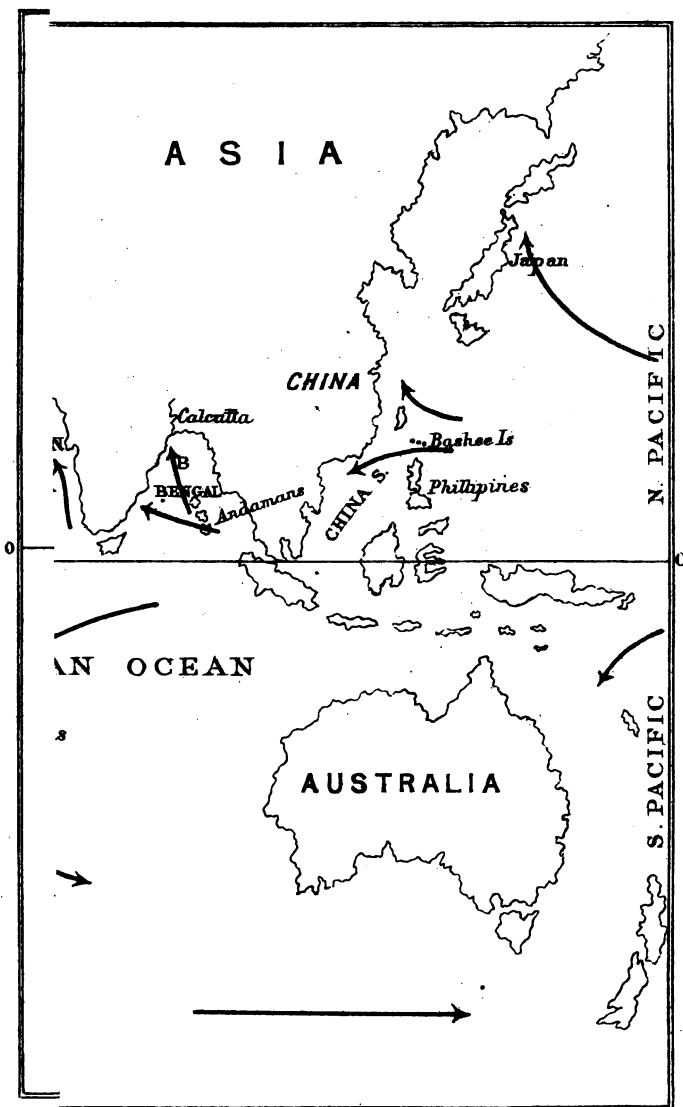












CATECHISM  
OF THE  
LAW OF STORMS

FOR  
THE USE OF SEA OFFICERS.

WITH INSTRUCTIONS FOR ANSWERING PAPERS ON THE SUBJECT IN THE  
BOARD OF TRADE EXAMINATIONS,

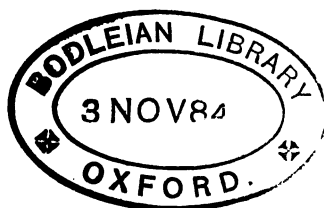
AND DIAGRAMS ILLUSTRATING BOTH THE  
CIRCULAR & INCURVING THEORIES,

A LIST OF THE BEST AUTHORS, &c.

BY  
J. MACNAB,  
*Examiner to the Liverpool Local Marine Board.*  
AUTHOR OF "GOING TO SEA," ETC.

LONDON :  
GEORGE PHILIP & SON, 31 & 32, FLEET STREET.  
LIVERPOOL: CAXTON BUILDINGS, SOUTH JOHN STREET,  
AND 49 & 51, SOUTH CASTLE STREET.  
1884.





## PREFACE.

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In launching this little craft, I wish to say that I claim nothing original for its contents beyond the setting of my subject before a nautical reader in his own language. I have no pet theories or crotchets to air—my little knowledge having been gained from those authors whose names will be found within, the wisdom of whose rules I have been enabled by personal experience to prove; and the same avenues to the science are open to every seaman.

Part I. is meant for the use of the young sea officer in the exercise of his calling. Part II. is for intending candidates only, and who have already studied the first part.

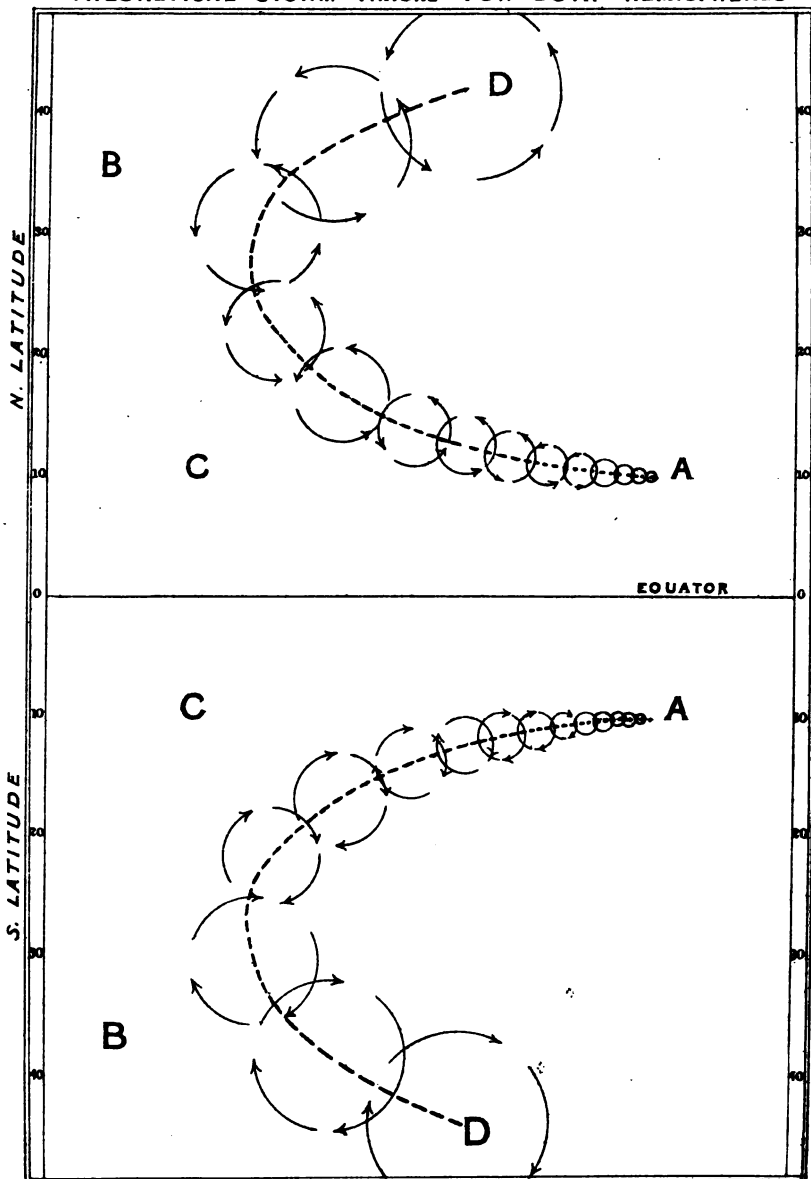
As to why I wrote this treatise.—Well, while not wishing to disparage the useful labours of other workers in the field, I may say I wrote it because I thought something of the sort *was* wanted.

THE AUTHOR.





# **DIAGRAM I** **THEORETICAL STORM TRACKS FOR BOTH HEMISPHERES**



In p  
 B, w

and that many Cyclones starting from A carry right on towards  
 about C travel towards D. This applies to both lats.

# CATECHISM

## OF THE

# LAW OF STORMS.

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THE growing interest taken in our knowledge of the principles and actions governing storms, especially those terribly destructive ones of the tropics, may be seen by the fact of the Government having lately included the subject in the examinations of all candidates for certificates of competency above the rank of second mate.

This step was taken in consequence of facts elicited at a Board of Trade Inquiry, where it was shewn that a slight acquaintance with the Law of Storms on the part of the master would have prevented disaster.

Little excuse can be urged by those concerned for ignorance of these laws, as many books on the science are published, and within the reach of all; we must perhaps attribute any shortcomings to want of attention to the subject, owing no doubt to a hazy idea that it was one too deep for a sailor, and more in the province of the learned on shore.

As proof that our sea officers have ample brains for the subject, it can easily be shewn that they include among them many eminent meteorologists; indeed, it seems they only need to be told to study the matter, and to the whole class our present knowledge of the Law of Storms will soon become as familiar as a "Day's Work."

The object of the present little work is to bring out and explain, in a simple manner, the most important

points in this branch of nautical science, and having thus paved the way to a fair knowledge of the subject, to furnish an intending candidate with a concise form of expressing the same on paper, so as to satisfy others that he really does know something of that which he professes to explain, and also, it is hoped, to incite the intelligent officer to a more perfect study of the whole matter.

Elementary works of this description, no matter by whom written, are no more fit to teach a science in full than is a child's primer to impart a thorough knowledge of our grand, though terribly difficult, English; they are written for a purpose, as above stated, and are eminently useful in the present case, as, owing to the great mass of reading in the larger works, together with the little time on land at a seaman's command, he has no fair opportunity of studying the subject at length until a higher position in his profession brings him more leisure.

It may here be proper to mention the names of a few authors of repute on the Law of Storms.

PIDDINGTON.—“*The Sailor's Horn Book.*” Although old, a first-class book still. Price 10s. 6d.

COLONEL REID.—“*Attempt to Develop the Law of Storms.*” Contains splendid reading. Price, with Charts, 25s.

Ditto.—“*Progress of the Development,*” &c.

W. R. BIRT.—“*Handbook of the Law of Storms,*” 5s.

PROFESSOR DOVE.—“*Law of Storms.*” Price 10s. 6d.

There are also works by Maury, Redfield, Thom, and Captain Jinman, all containing most useful information, while any work by the Rev. Mr. Ley, or Mr. Meldrum of the Mauritius, would be extremely valuable,\* as is the new

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\* “*Notes on the Form of Cyclones, &c.,*” by C. Meldrum, F.R.G.S. 6d.  
 “*Aids to the Study and Forecast of Weather,*” by the Rev. W. C. Ley, M.A. 1s.

official "*Barometer Manual*."\* Messrs. Ley and Meldrum are advocates of what are known as the "Incurving" and "Spiral" theories, or where storm winds, instead of blowing all around in a circle, are constantly curving towards the centre. Birt's Handbook describes this clearly; but for laying the foundation of a perfect knowledge of the science, we would advise a study of Piddington or Reid to begin with. True, they deal mostly with the Circular theory; but that theory is not exploded yet, nor does it seem likely to be so, although cases of spiral or incurving storms may from time to time be proved. The usually well informed Marine Department of the Board of Trade have decided, in the present state of our knowledge, to accept the circular theory of storms in the answers of candidates, nobody of course being precluded from answering according to the other.

For the remainder of this work, the information will be conveyed by the question and answer system, the language used being that of one sailor towards another, avoiding all superfluous scientific terms and technicalities.

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## PART I.

Q. 1.—What is the meaning of the term "Law of Storms?"

A.—Certain laws which, experience has proved, govern the actions of those great revolving storms which, under various names, such as Hurricanes, Cyclones, Typhoons, &c., rage in various parts of the world, being most marked and destructive within the tropics.

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\* "*Barometer Manual for the Use of Seamen*," issued by the Meteorological Office. 1s. 3d.



Q. 2.—Are our Atlantic and other high latitude gales sometimes cyclonic or revolving in character?

A.—Yes, but covering more of the earth's surface, pursuing a different track, and not usually having winds so strong as the tropical cyclones.

Q. 3.—Where do tropical cyclones originate?

A.—Speaking in general terms, they have their origin in low latitudes, say  $10^{\circ}$  N. or S. of the line.

Q. 4.—Describe their form then.

A.—Circular (see Diagram 2); wind blowing around a small vortex or centre spot, which in time becomes larger as the cyclone grows, and is a region of calms, disturbed at times by terrific shifting squalls.

Q. 5.—Does the storm remain in the place where it began?

A.—No; the whole body of it moves off in a westerly direction, but always inclining more or less *from* the equator in either N. or S. lat.

Q. 6.—As the cyclone moves forward, describe its actions.

A.—It gradually expands in volume, meanwhile increasing in its rate of progression, until meeting with land, or about to recurve, when it may become almost stationary for a while. It is known that in some storms the wind at times departs from a purely circular course, and curves toward the centre. See Diagram 3.

Q. 7.—Why is there such a dread of the storm centre?

A.—Because in it a ship is liable to be overwhelmed by its tremendous pyramidal sea, aided by violent gusts of wind from different quarters, these having flat calms between them.

Q. 8.—What is meant by a storm “track,” or “line of progression,” and how is it spoken of?

A.—The path, track, or course, along which the whole body of the cyclone is moving. The track of the *centre* is what is always meant, unless differently expressed, and is spoken of as would be a course steered, or the set of a current, *i.e. towards* the way it is going: not as we name the direction of the wind—*from* such a point.

Q. 9.—For convenience, how is a cyclone divided?

A.—Into two great halves, named the Right and the Left hand sides or semicircles. Looking from behind the centre of the storm in the direction in which it—*not the wind*—is going, that half of the area on your right of the track is called the Right, and that on the other, of course, will be the Left. It is advisable to use these terms instead of port and starboard.

Q. 10.—How does the wind revolve around the centre space of a cyclone?

A.—In the Northern hemisphere against the hands of a watch lying flat. In the Southern the opposite way, or with watch hands. Otherwise, in N. Lat. against, and in S. Lat. with, the sun, as sailors speak.

Q. 11.—Is it known at what rate cyclones travel?

A.—Yes, fairly: from 4 or 5 miles an hour at their origin, the rate gradually increases up to 15, 20, or more miles per hour. *This does not mean the speed of the wind round the centre, which may be up to*

100 miles per hour. When recurving or near land, the storm may, however, move very slowly. See No. 6.

Q. 12.—From the revolving nature of the wind, then, is it possible for different ships in the same cyclone to have different winds?

A.—Certainly. If by a straight line you divide a storm area into two halves, all vessels in one of these semicircles will encounter winds from different, or in some situations, opposite, directions from those being felt by ships in the other semicircle. Refer to Diagram 2.

Q. 13.—Does land affect the progress of cyclones?

A.—Yes, materially. A cyclone coming straight in upon a coast from the sea will not generally proceed very far inland\* until it disperses; or it may hover a while on the coast and then turn off at an angle. If approaching the coast slantingly, it will be repelled, and alter its course to one parallel to that coast.

Q. 14.—What is known of the dimensions of cyclones?

A.—They vary much. A storm which in latitude  $10^{\circ}$  might be only five or six miles in diameter, may on arriving at latitude  $25^{\circ}$  or  $30^{\circ}$  measure five hundred miles across; while in higher latitudes they have been known to attain a diameter of 1000 miles.

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\* They have, however, been known occasionally to cross a large tract of land, as the Indian Peninsula, Island of Cuba, &c.

Q. 15.—Can a ship's distance from the centre be estimated?

A.—Not safely, the storm's diameter being uncertain. An *idea* may be formed from the rate of falling of the barometer, and the rapidity of changes of wind and sea—all being quicker and more aggravated as the centre is approached.

Q. 16.—What effect has a cyclone on the sea?

A.—Heaps it up in the centre, and creates immense waves, which, running in different directions, like the winds which produced them, cause the terrific cross sea of these storms.

Q. 17.—In what parts of the storm area is this sea worst?

A.—In the centre, and in the hinder side of the storm, the latter being where the centre has just passed over. The centre has a peculiar sea of its own, the water rising in great pyramidal heaps, and literally throwing itself about in all directions, making it difficult for a ship to live.

Q. 18.—Do these storms travel along a straight line for any distance?

A.—From the volatile nature of air, and that in a cyclone being in a state of violent agitation, it is most likely that they do not, but oscillate or swing to the right and left as they proceed. The track usually mentioned is but the average course made good of all these oscillations.

Q. 19.—State in general terms how the barometer is affected by a cyclone.

A.—Outside the verge of a cyclone the instrument generally stands higher than it should for the locality. Entering the storm area, it falls until the

centre is arrived at, which having passed it again rises as the edge is approached, an entire fall of 2 or  $2\frac{1}{2}$  inches being common, although much less may be found in heavy cyclones.

Q. 20.—Are there any “straight line” winds?

A.—Yes. Trade-winds and Monsoons are not cyclonic, although the latter sometimes blow hard.

Q. 21.—How can you tell the difference between an ordinary Monsoon gale and a cyclone?

A.—By the barometer not falling much, nor continuing to fall in the former, the wind and sea keeping steady in direction, and by the very different signs in the weather.

Q. 22.—Give the usual indications of the approach of a cyclone in the tropics.

A.—Generally the weather becomes unsettled a day or so previously, and a long rolling sea sets in from where the storm is. Next, the barometer begins to fall (see No. 19); the thermometer rises as the atmosphere becomes more sultry, and ultimately the appearance of a dense bank of cloud betokens that the dread visitor is at hand. As it draws nearer, the wind rapidly freshens, and seems to be tearing great ragged pieces of cloud from the bank. The sea now begins to run higher and cross, the sky presents a wild and terrifying appearance, while the true hurricane wind comes in ever increasing squalls. When fairly involved, the ship will find herself in a dreadful war of the

elements, sea and sky literally mingled together, the wind coming in irresistible gusts in rapid succession, with—one might say—a whole gale for broken stowage. In some cyclones there is much lightning, but the thunder is inaudible amid the roar of the storm.

Q. 23.—How is it at this time in the centre?

A.—According to theory, the centre space should be calm, but experience has proved that this is not *always* so. In it one may encounter terrific gusts from any point, with calms between, while the sea boils and rises in great pyramidal heaps.

Q. 24.—Supposing a vessel to have survived the passage of the centre over her, describe the phenomena she will experience in the hinder part of the storm.

A.—Immediately the centre space begins to recede from the ship, her barometer starts to rise, the squalls become less violent, and occur at lengthening intervals, the wind settling down into more of a steady gale, but the sea will still run dangerously high and cross. As the storm passes further away, the sky begins to clear, and the barometer rises to its proper level.

Q. 25.—What is meant by this expression “proper level”?

A.—In every part of the world there is a certain average height of the barometer, where it ought to stand in the ordinary weather for the season. These heights are known, and are given in any good “Directory,” and any departure therefrom,

especially in the tropics, should be at once noticed. See No. 19. There is, however, a small diurnal motion of the mercury noticed in the fine weather of tropical regions; that is, it rises and falls every 12 hours about half a tenth, the highest points being reached at 10 A.M. and 10 P.M.; the lowest at 4 P.M. and 4 A.M. These movements need excite no apprehension, but if, say at 8 A.M. or P.M., when a slight rise should be in progress, a fall be noticed instead, and the top of the column of mercury be concave or cupped (a sign of falling, as its being convex or bulging up is of rising), that is a symptom which should at once be attended to.

Q. 26.—In your description of the weather of a cyclone, you omitted to mention the changes of wind?

A.—Yes, purposely, as it can better be done now that we understand what a cyclone is, its form, rotation, and progressive motion. Writing for seamen only, we shall employ a sailor's verbiage, and use the word "shift" as meaning a *sudden* change of wind; "hauling," when it draws round right-handedly; and "backing," when to the left. These terms should never be confounded.

The changes of wind in a cyclone are, to a stationary observer, dependent upon (a) the revolving or spinning motion of the air round the vortex, or centre, and (b) the forward movement of this vortex, and with it, of course, the whole storm body. Take the case where the observer is on the line of progression, right in front of the

storm; theoretically he should have no change in the direction of the wind as the centre bore down upon him. This having passed, the wind should, by the "circular" theory, strike him from the opposite point to where it had left off blowing, and should remain in this latter direction till all was over. Any departure from this state of things in the hinder half could only be caused by an alteration of the line of progression, known as *recurving*, or by the storm being one of those incurving or spiral cyclones figured in Diagram 3. Again, if our supposed stationary observer be *not* on the line of progression, and therefore not to have the centre pass over him, he will find the wind veering more or less gradually as his position happens to be near to or removed from the storm track; the quickest changes occurring, not in the outer edges, but in the inner parts of the cyclone. Should only a small portion of the storm pass over him, the change in direction of wind would be little.

Q. 27.—It seems easy enough to see through this. What, then, is it which causes the seaman actually involved in a cyclone sometimes to find things very different?

A.—The motion of his own vessel, which adds another and very complicating element to the question as to how the wind should act. The cases we have given suppose the observer to be fixed in one spot, with the storm passing over him; now we have the same conditions (*a*) and (*b*), but the observer constantly changing *his* place. Even if hove-to,



a ship will drift; but suppose she be running 8 or 10 knots an hour at any angle to a storm track, she is bound to alter her place in the area, and therefore meet with winds of different character to those she would encounter had she been stationary.

Nothing shews all this better than the transparent storm cards, (Col. Reid's invention, we believe). You can make them yourself out of a piece of thin notepaper dipped in spirits of turpentine or in oil and dried. Each copy of Piddington's book contains a pair ready for use in either latitude. Placing a spot on the chart to represent the ship, put the card over it, proper edge north, and direction of wind shewn by the circle right over her place. Now draw the card along the line of progression and you can see what different winds you will meet if stationary; and even with this valuable aid it will take a deal of study to trace out the changes if your ship be also in motion.

Q. 28.—Are there any rules for ascertaining the position of a ship in a cyclone, and for the changing in direction of its wind?\*

A.—Yes; most important ones.

First: To find how the centre bears. When fairly within the storm area, *not before*, face the wind, and the centre should bear about 8 points from that to the RIGHT in N. Lat., and to the LEFT in S. Lat. This average, or 8 point, bearing, is based on the old theory that the area is a perfect circle; but as it is now generally accepted that some may be "Incurving," it may be as well to allow for such a possibility, in which case the

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\* On first indications of a cyclone the careful navigator will heave-to until satisfied as to how it is acting.

centre bearing might even vary from 8 to 14 points. For examination purposes, however, the Board of Trade, as said previously, have decided to accept the 8 point theory, assuming that candidates after passing will study the subject more fully. As to the laws of change of the winds, a look at a diagram or storm card will shew that either to the north or south of the equator the winds will "haul" RIGHT handedly in the RIGHT side of any cyclone, and "back" to the LEFT in the LEFT side (see Nos. 9 and 10).

NOTE.—This supposes the observer to be stationary, or nearly so. A ship sailing or steaming fast through a cyclone may cause things to *appear to her* the very opposite. See last No.

Q. 29.—From this knowledge are there not certain useful rules deduced for the management of a ship in a cyclone?

A.—Yes, but being *general* rules, a careful study of the subject is needed before attempting to apply them to individual cases. When well into a severe cyclone, few ships can be handled otherwise than by heaving-to, it being only in the outer part where they can safely "run," or "carry sail."\* Leaving this point to be settled by the intelligent seaman on the spot, we shall give the best known rules for the ship's management afterwards.

*For running, or for carrying sail.*—In N. LATS. keep the wind on the STARBOARD quarter or side. In S. LATS., PORT quarter or side.

This leads her *from* the centre.

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\* For definition of "Run," &c., see instructions.

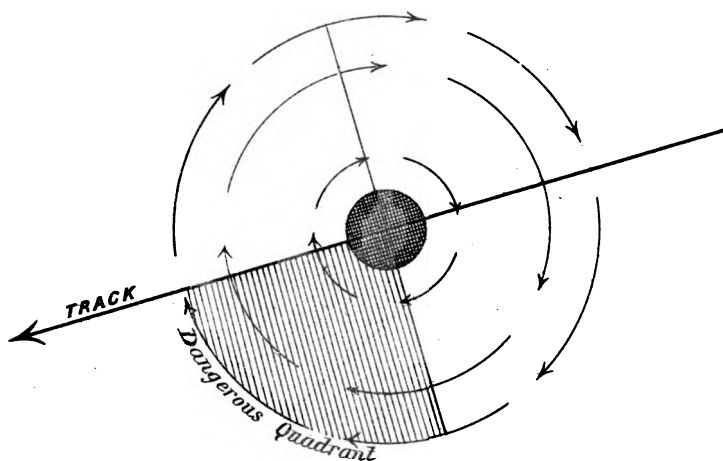
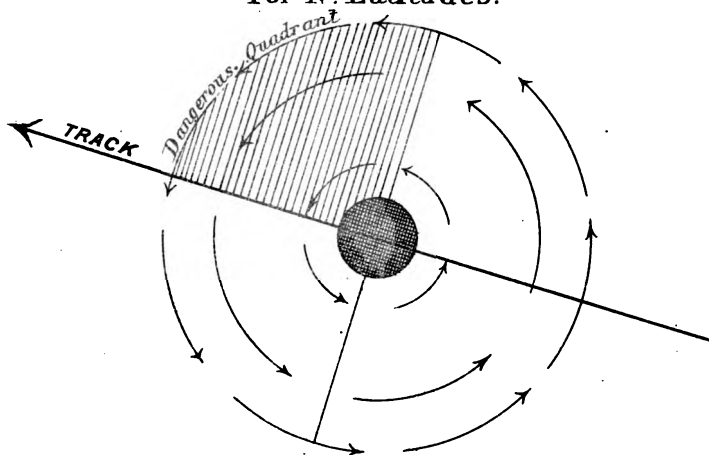
*For Heaving-to.*—In the RIGHT-HAND SIDE of a storm in any latitude, STARBOARD TACK. In the LEFT-HAND SIDE, any latitude, PORT TACK.

The object of this is that in each case the ship comes up, instead of falling off, as the wind changes.

It is reckoned dangerous to run in any cyclone with the wind *dead aft*—highly so if in the “dangerous” quadrant, or if in *any* portion of an Incurving storm (see Diagrams Nos. 2 and 3).

A line through the centre, and at right angles to the line of progression, will, with the latter line, divide the storm area into four quadrants. One of these is the most dangerous of all, and is in N. Lat., the advancing or front right-hand quadrant; in S. Lat. the front left-hand one. Both are shaded dark in the Diagrams No. 2, which refer to circular storms only, the size of this work and our knowledge of other varieties being too limited to allow of more definite treatment here. The evil of these “dangerous” quadrants lies in the fact of their winds blowing a vessel *towards* the line of progression of the centre, to which also there is a tendency of the water to flow. If caught in one she dare not heave-to; and if well in front, and on the outer verge, she must perhaps be sailed across the storm track, to avoid the terrible centre bearing down upon her. In this case, then, see your ship in good order, and run with wind on the correct quarter, until, by the changing of the wind and the rising of the

## DIAGRAM 2 For N. Latitudes.



For S Latitudes

*Diagram showing circulation of winds and dangerous quadrants in Cyclones. Circles like these, omitting the long "track" arrows and shaded quadrants, can be easily made out of thin note paper, dipped in spirits of turpentine to render them transparent for use as "storm cards." In using these, be sure to have them right side up, or they will read the reverse way.*



barometer, you are sure of having passed the line of progression, and reached a safe position in the other side of the storm, where the ship may be hove-to on the proper tack, as already directed. This crossing in front, being very risky, should only be attempted when one is sure of his position, and of the way the storm is travelling.

A vessel taking this quadrant not so far in front, or where it is doubtful whether in a front or hinder quadrant, is not so compelled to run as in the former case: she should carry sail *from* the centre, keeping the wind as far forward as possible.

If running in any portion and the glass fall, the wind must be if possible brought more on the quarter or side, or the ship hove-to and the worst taken, for the vortex is certainly nearing her.

These rules mostly refer to sailing ships. Well equipped and not overloaded steamers can always find their way out of a cyclone by steering in the right direction, *i.e.*, keeping the wind well on her Starboard side in North Latitudes, and on her Port side in South Latitudes, in either semicircle, taking care she is not steering in front of and the same way as the storm. In these directions the ships are supposed to be in open sea; when near land the case may be materially altered, as a lee shore has to be avoided. Also, in places where it is known cyclones usually recurve or change their course, a different treatment may be required, calling for the utmost skill; and it is to meet such cases that I recommend a proper study of the subject.

Q. 30.—In the Left side of a storm in N. lat., it is recommended for a ship to go on the port tack, &c. Is not her head then toward the centre?

A.—Yes; but her way is small, and it was assumed that before being hove-to she had been run into a safe position, and at too great a distance to drift into the centre.

Q. 31.—It has been stated that cyclones may travel as slowly as 4 or 5 miles per hour. Any ordinary vessel can overtake such a storm from behind; describe the phenomena she would observe in so doing.

A.—The alteration in the weather would be similar to that described, but slower; the glass also would fall slower, but a certain indication would be the terrible confused sea of the storm wake. If entering either the right or left hand side of the cyclone, the changing of the wind would be the *opposite* way to that given in No. 28, so that an overtaking ship would find winds “backing” in Right, and “hauling” in the Left hand semi-circle in either hemisphere.

Q. 32.—Can a ship sometimes make a fair wind out of a cyclone?

A.—Yes; but with great caution. It can only be done in a part of the ocean not near land, and where cyclones are never known to recurve. The ship must be on the outer verge of the storm, not in front, and be bound in a direction similar to that of the cyclone, watching her glass attentively,

should it fall, hauling her more out. The wind should be kept a little on the proper quarter (see No. 29).

Q. 33.—A beginner is likely to be confused by the rules for running, and for heaving-to: state their points of difference.

A.—You are told to RUN with the wind on the starboard quarter in North Latitudes; on the port quarter in South. This is to lead you from the centre with speed.

You are told to HEAVE-TO on the starboard tack in the Right hand, and on the port tack in the Left hand side of a storm in either hemisphere. This is to prevent your breaking off, or being taken aback.

Briefly then—RUNNING depends on LATITUDE only.

HEAVING-TO on RIGHT OR LEFT HAND SIDE, totally irrespective of latitude.

*This is most important to remember.*

Q. 34.—How can a seaman tell whether he is in a circular, or an incurving or spiral cyclone?

A.—He will find it at first very difficult, or impossible, and should treat it as circular, making sure that he is not overtaking the storm. Should he then find the phenomena different from what they should be, he may conclude the cyclone is not circular, and try to raise his barometer by sailing with wind *well* on the quarter or side. The tracks of incurving storms are the same as those of



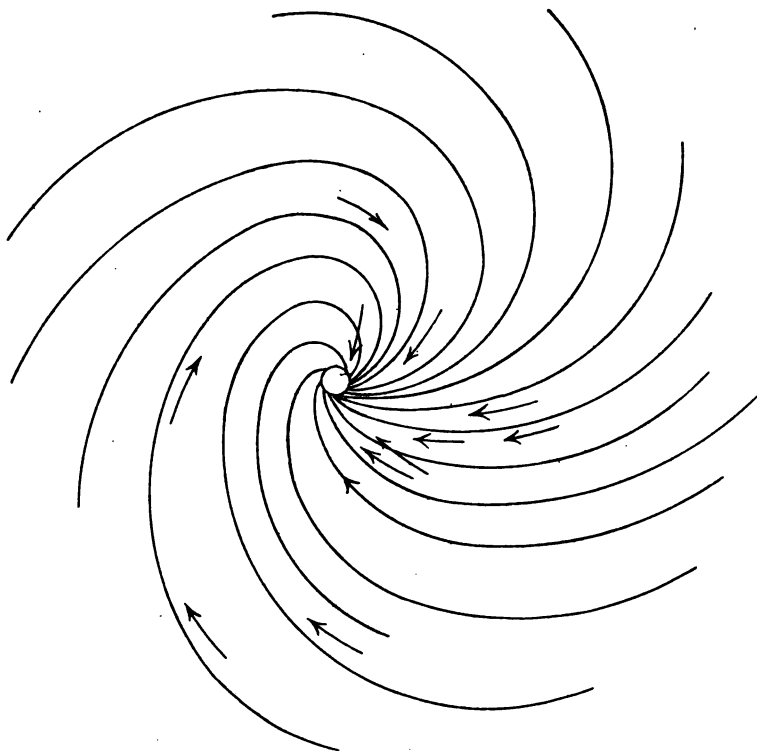
circular, and should be well kept in mind as the navigator proceeds. He will of course remember that they all vary considerably. Mr. Meldrum is, we think, the best authority on spiral storms.

The incurving or spiral theories seem to afford a more feasible explanation than does the Circular, of those familiar sudden shifts of winds in the winter gales of the N. Atlantic from S.W. to N.W., and in those of the Southern Ocean from N.W. to S.W. Still the state of our knowledge in this particular is far from perfect, one set of theorists devising most elaborate schemes only to see them disproved by another set. Despite all this, we have abundant evidence to show that the grand old theories of Reid and Piddington, with the rules deduced therefrom, are right in the main, and when fairly acted upon, sufficient to guide the intelligent sailor in the hour of trial, especially within the Tropics.

It is also satisfactory to know that the subject is engaging the attention of the great centres of learning as well as that of the nautical world, for now we have the University of Cambridge offering a very high reward (the Adams Prize for 1885) for the best investigation of "the laws governing the interaction of cyclones and anti-cyclones on the earth's surface."

When the results of these labours in abstruse mathematical research take the more tangible form of principles whereon to found practical rules, it is to be hoped that to our "Toilers of the Deep" may be presented an improved method of dealing with those dreaded storms, the destructive powers of which are already so well known.

### DIAGRAM 3.



S. Hemisphere.

*Diagram to illustrate the Incurving Theory of Cyclones,  
after Meldrum.*



## A WORD TO THE MATE.

Most writers on Cyclones content themselves with describing manœuvres on open sea, so that a word to officers as to what they should do in port may not be out of place here, especially when it may at times occur that a severe storm comes on when the captain is on shore, and unable to reach the ship.

In most ports visited by cyclones there are certain signals made by the harbour authorities on the approach of these dreaded visitors. The officer should early make himself acquainted with those signals, through the pilot or otherwise, and keep a careful watch for them, as well as on his own barometer. If lying out in the river or harbour, he should keep his second anchor ready, seeing that no impediments exist to the free running of the chain. He should also mark his best hawser, which by the way is not always the biggest, as large towropes are supposed to last for ever, and often remain on board long after they ought to be in the Marine Store. This best or strongest hawser should be always kept handy for bending on to a spare anchor in case of needing to drop one from either bow or stern, and in the officer's head should be also kept ready for use plans for utilising this spare gear. He should know the lengths of his mooring chains and hawsers, and have shackles ready for the former should he want to bend them.

A careful mate will also see that his upper spars can readily be sent down when required. When a cyclone is expected, he should at once furl awnings and stow them away, strike topgallant yards and masts, unreeve all unnecessary gear, see lower and topsail braces clear for

running, as the yards must be kept pointed during the gale. Have no heavy cargo gear aloft to fall and kill people, block off all loose cargo below, and send lighters on shore. Close all ports and batten down hatches, hoist in boats, secure everything from tumbling about, and fix a purchase for lifting the spare bower anchor on to the forecastle head. He will, besides, reeve off a couple of strong luffs, ready to clap on the chains abaft the windlass to ease the strain.

A steamer should take all the above precautions, and, in addition, get up steam on her main boilers.

It must be remembered that a ship will ride out more bad weather with one anchor and a long scope of chain, than with two and a short scope. Still there is a golden rule—*“Never let your ship go ashore with an anchor hanging at her bow.”*

While on this subject there is a matter which is worthy of remark. There is in almost every vessel one anchor termed the “working anchor.” In days gone by this was considerably lighter than the other, or “best bower,” but of late years there is scarcely any difference; still one of the two is yet looked upon as the working one, and as a rule is most used. The writer has often wondered at the want of knowledge displayed by otherwise competent men of the reasons why a working anchor should be kept on a particular bow. By old tradition the port one was that used, and our forefathers were right in their day, when crossing the Line was not so common as now. In the N. hemisphere they knew that the winds mostly hauled right-handedly, and therefore let go their port anchor first.

Take a case in point. A ship is lying to her port anchor in Penarth Roads. It comes on to blow from the

S.W.; she pays out chain to 75 fathoms. The wind increases, she drops her starboard anchor, pays out 30 fathoms on it and on the other; now the wind is at W.S.W., and she riding with 105 and 45 fathoms out. Wind shifts to N.W. blowing tremendously, there is no more chain to give on the port, but the starboard anchor will take plenty of it, and finally at slack water the ship lies S.E. of her anchors, with a long scope on each and *no cross in her chains*. Had the vessel been hanging to the starboard anchor at first, the second one would have carried its chain under and across the former, giving a foul hawse, while the last anchor let go would run a good chance of being hooked by the bight of the first chain.

For similar reasons the starboard should be the working anchor in South Latitudes.

TABLE I.

## AVERAGE TRACKS AND SEASONS OF TROPICAL STORMS.

LOCALITY.	TRACKS, &c.	SEASONS.
W. INDIES. (N. Atlantic.)	These cyclones originate in about 10° or 12° N. Lat., and from 40° to 60° W. Long. They then proceed in a W.N.W. or N.W. direction toward the islands, in the vicinity of Cuba or Bahamas recurving to the Northward. If not spent here, they follow the course of the Gulf Stream to the N.N.E. and E.N.E., sometimes as far as Europe.	July to October, worst months Aug. and Sept.

TABLE I.—(continued).

NORTH PACIFIC.	Originate in about Lat. 10° or 12° N., and in various Longitudes; then travel W.N.W. and N.W., recurving in Lat. 20° or 25° to N. and N.E.	Same months as above.
SOUTH PACIFIC.	Originate in Lat. 10° or 12° S., proceed W.S.W. and S.W., recurving in about 25° S. to South and S.E	Same months as Indian Ocean.
INDIAN OCEAN.	Originate in Lat. 10° or 12° S., proceed W.S.W. and S.W., recurving in about 25° S. to South, S.E., and sometimes E.S.E. Near Mauritius, cyclones travel towards S.W.	From Dec. to April, worst months Feb. and March.
ARABIAN SEA.	From the neighbourhood of the Laccadive Islands they travel about W.N.W., curving northerly towards the Arabian Coast. Cyclones not frequent.	Change of Monsoon, April, May, June, and Sept., Oct., November.
MALABAR COAST.	Tracks, up along shore to the N.N.W.	Ditto
BAY OF BENGAL.	Originate near the Andaman Islands; some travel westwards toward the Madras Coast, others steer a more northerly course to N.W. and N.N.W. till they spend themselves among the low islands at the head of the Bay.	May and June,  Oct., Nov.  Two latter worst.
CHINA SEAS.	Originate near the Phillippine or Bashee Islands; travel between W.N.W. and W.S.W. towards the China Coast. Many go more to N. or S.	May to November. Aug., Sept., Oct. being worst months.
JAPAN.	Come in from the Pacific travelling W.N.W. or N.W., recurving on the coasts to the Northward.	Same as China Sea.

TABLE II.

USUAL TRACKS OF STORMS IN HIGH LATITUDES.

LOCALITY.	TRACKS, &c.	WORST SEASONS.
WESTERN OCEAN.	E.N.E. towards British Isles.	Heavy gales any time from Sept. to March.
N. PACIFIC.	E.N.E. towards British Columbia.	Ditto.
S. PACIFIC. CAPE HORN. S. INDIAN OCEAN. CAPE OF GOOD HOPE.	Tracks mostly East or E.S.E. in all these waters, the storms of Cape Horn being noted for clouds, rain, and low barometers.	The Austral winter, July and August, being reckoned worst months.

NOTE.—In all the above localities severe short storms may occur at any time.

## PART II.

## INSTRUCTIONS

FOR ANSWERING PAPERS ON THE LAW OF STORMS  
IN BOARD OF TRADE EXAMINATIONS.

The questions set to candidates are framed with a view to elicit the fact of their possessing sufficient knowledge of the subject to avoid making any gross errors in the management of ships in cyclones. They are the simplest that could well be framed, but, no doubt, will bye-and-bye be added to. All answers may be based on the purely circular theory, that is, allowing 8 points for finding the centre bearing, and on the rules for escaping the centre as given in answer to Q. 29 of the Catechism.



Having answered No. 1 as directed in the examples, read No. 2 attentively. (*Never attempt to answer any question without first reading it carefully from end to end*). Next, look at No. 6, and see what locality is named; now draw a little circle, no matter how rude or crooked, on the margin of your paper, abreast of where the answer to No. 2 is to go; put little arrow barbs on the circle, to shew which way the WIND is revolving, (see Diagram 2), and a long straight arrow through the centre, also barbed, to shew the way the STORM is travelling; the arrows being supposed to fly *with* the wind or storm, not *against*. A look at your circle will shew where the ship was, first when she had the wind as given in No. 1, and next her place when it has changed, as in No. 2.

Theoretically, the storm should be travelling parallel to a line joining these two positions; should this differ from Table I. the case must be considered as unusual, and a track assumed as indicated by the change of wind. Example III. is a case of this. *These remarks do not apply to Q. 6.*

Having ascertained where the ship is, proceed to answer No. 2, taking as a guide the answers given in the following examples, carefully varying them to suit the case. Note particularly if she is in the "dangerous quadrant," if so, do not state in your answer that you would *run*.\* See Example, Paper 1.

A commander should only cross the storm track when on the outer verge actually in front; and in the questions

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\* Do not confound the terms used. Remember that "Running" means keeping the wind well aft, say from two points abaft the beam to right aft. "Carrying sail" is meant to convey where the ship is carrying on with wind from two points abaft the beam to "sharp up," while when "Hove-to" she is supposed to carry only steadying canvas, and to have no steerage way.

he is supposed to have let the storm involve him somewhat, when this move might be too late. In answering No. 2, then, a course should, if possible, be made at *right angles* to the line of progression, keeping the wind on the proper side for the latitude. Starboard side for N., Port side for S. Lat. (see No. 29), and note your circle to determine whether the direction of the wind allows it. Don't make her go *head to wind*.

The winds and their changes given in Nos. 1 and 2 are, or should be, always dependent upon the locality named in No. 6, in order to be practical. From the outset of the study, the small Map of the World in this work, with the different storm tracks drawn upon it, also Table I., should be frequently consulted, until you get a fair idea of how cyclones travel in all the various localities, and the information gained will be found good in the day of trial. Do not be too long-winded, nor yet too short in the answers. We have annexed four Example papers, thinking that quite sufficient to shew a fair *style* of answering, and allowing the candidate to exercise his own brains in framing answers to any other cases that may be put. Replies might be appended to suit every locality, but that would only swell the bulk of the book, and encourage what we dislike—cramming.

Nos. 3, 4, 5, being fixed questions, the answers given in the example papers will suffice.

In answering No. 5, it is well to mention what is seldom done by candidates—the appearance of the weather, &c.; also that a ship in a cyclone does not find the wind continually “shifting,” or flying all around the compass, as some persons think. Near the centre only may you talk of “shifting,”—for all other portions of the area it is best to use the word “change.”

Regarding the locality given in No. 6. If only an Ocean be named, doubt may arise as to what part of that ocean is meant when the diagram to No. 2 is to be drawn, as, for example, "Indian Ocean." Here storms may be going W.S.W., S.W., S., S.S.E. or E.S.E., according to latitude. In such a case the wisest course is to name all these courses in the answer to Q. 6, and for Q. 2 assume the track to be that indicated by the *changes of wind* in Q. 1 and 2.

In all books on this subject the compass points meant are True.

## EXAMPLES.

## QUESTIONS RELATING TO CYCLONES OR REVOLVING STORMS, COMMON IN TROPICAL SEAS.

## No. I.

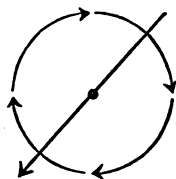
The candidate must answer in writing, on paper supplied to him by the Examiner, the following questions, numbering the answers to correspond with the questions.

Q. 1.—The direction of the wind in a cyclone being \* East, state the probable bearing of its centre from the ship, in the \* Southern Hemisphere.

A.—About North.

Q. 2.—And suppose that the wind during the passage of the same cyclone was found to change toward the \* N.E., what would be the ship's position with reference to the line of progression of the centre of the cyclone; and what action would you take?

A.—The ship would be in the left hand side of the storm. I would carry sail with the wind on the port side until in a safe position, and then, if needed, heave her to on the port tack. Should barometer again fall, sail her, if possible, as before further out.




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\* These spaces to be filled in by the Examiners, and frequently varied.

Q. 3.—Under what conditions would the change in the direction of the wind in the cyclone be the reverse of the above?

A.—If the ship were in the opposite semicircle, or if overtaking or going faster than the storm on the same side as before.

Q. 4.—What are the usual indications of a ship being on the line of progression of the centre of a cyclone?

A.—The customary signs of an approaching cyclone as regards barometer, sea, and sky, but no change in the direction of wind until the centre has passed, when it will blow from the opposite quarter.

Q. 5.—What are the usual indications that a ship is (*a*) approaching the centre of a cyclone; (*b*) receding from it?

A.—(*a*) Barometer falling; sea getting up. Threatening appearance of the weather. Dense cloud bank. Gale rapidly increasing in violence, with terrific squalls quickly following each other. Wind changing (except she is on line of progression); the sea becoming cross and dangerous. (*b*) Barometer rising; wind abating and sky clearing; but sea still confused and dangerous.

Q. 6.—Describe the track usually taken by cyclones in the Indian Ocean, near \* Mauritius; and state the seasons of the year in which they most frequently occur in that region.

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\* The Examiners to fill in whether North Atlantic, Bay of Bengal, China Seas, Indian Ocean, &c. &c.

**A.**—In this region storms mostly travel towards the S. Westward. The season is from December to April; February and March being the worst months.

**1.**—Allow 8 points to the left for S. hemisphere.

**2.**—Wind backing from E. to N.E., you are in the left hand side. Now look at Q. 6, and you will see the locality is given as Mauritius, where cyclones mostly travel S.W. Calling the top of your paper the North, draw a little diagram as in the margin with a long arrow to shew the way the storm is moving. This will at once indicate the ship's position as in the southern verge of the storm, in the "dangerous" quadrant. To run would be to cross the advancing front; but by the answer given, she has been headed away S.E. from the track.

**3-4-5.**—Need no alterations or remarks. See instructions.

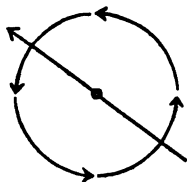
**6.**—Express this as the case requires. A little study of Table I. and the Map will enable the student to put it briefly and to the point.

## No. II.

**Q. 1.**—The direction of the wind in a cyclone being North, state the probable bearing of its centre from the ship, in the Northern Hemisphere.

**A.**—About East.

**Q. 2.**—And suppose that the wind during the passage of the same cyclone was found to change toward the N.N.W., what would be the ship's position with reference to the line of progression of the centre of the cyclone; and what action would you take?



**A.**—The ship would be in the left hand side of the storm. I would run her with the wind on the starboard quarter, until in a safe position, and then, if needed, heave-to on the port tack. Should barometer again fall, run her as before, further out.

Q. 3.—Under what conditions would the change in the direction of the wind in the cyclone be the reverse of the above?

A.—If the ship were in the opposite semicircle, or if overtaking or going faster than the storm on the same side as before.

Q. 4.—What are the usual indications of a ship being on the line of progression of the centre of a cyclone?

A.—The customary signs of an approaching cyclone as regards barometer, sea, and sky, but no change in the direction of the wind until the centre has passed, when it will blow from the opposite quarter.

Q. 5.—What are the usual indications that a ship is (a) approaching the centre of a cyclone; (b) receding from it?

A.—(a) Barometer falling: sea getting up. Threatening appearance of the weather. Dense cloud bank. Gale rapidly increasing in violence, with terrific squalls quickly following each other. Wind changing (except she is on line of progression); the sea becoming cross and dangerous. (b) Barometer rising. Wind abating and sky clearing, but sea still confused and dangerous.

Q. 6.—Describe the track usually taken by cyclones in the West Indies, and state the seasons of the year in which they most frequently occur in that region.

A.—In this region storms mostly travel towards the W.N.W. or N.W. The season is from July to October. August and September being the worst months.

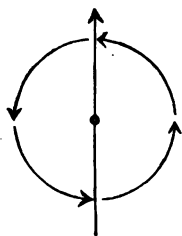
- 1.—N. Hemisphere. 8 points to right.
- 2.—Wind backing: ship in left hand side. Diagram shews ship's place to be in front left hand quadrant, not the dangerous one. She must be at once run away to S. ward far enough to lie to. Note the difference between this and the last case in Ex. I. when she had to "carry sail."
- 6.—Had N. Atlantic only been given, it would include W. Indies and all the Western Ocean. In such a case, give courses for all the way from Table I.

## No. III.

Q. 1.—The direction of the wind in a cyclone being S.S.E., state the probable bearing of its centre from the ship in the Northern Hemisphere?

A.—About W.S.W.

Q. 2.—And suppose that the wind during the passage of the same cyclone were found to change toward the S.S.W., what would be the ship's position with reference to the line of progression of the centre of the cyclone; and what action would you take?



A.—The ship would be in the right hand side of the storm. I would sail her with the wind on the starboard side, until in a safe position, and then, if needed, heave-to on the star-board tack. Should barometer again fall, sail her as before, further out.

Q. 3.—Under what conditions would the change in the direction of the wind in the cyclone be the reverse of the above?

A.—If the ship were in the opposite semicircle, or if overtaking, or going faster than the storm on the same side as before.



Q. 4.—What are the usual indications of a ship being on the line of progression of the centre of a cyclone ?

A.—The customary signs of an approaching cyclone as regards barometer, sea, and sky, but no change in the direction of the wind until the centre has passed, when it will blow steadily from the opposite quarter.

Q. 5.—What are the usual indications that a ship is (a) approaching the centre of a cyclone ; (b) receding from it ?

A.—(a) Barometer falling : sea getting up. Threatening appearance of the weather. Dense cloud-bank. Gale rapidly increasing in violence, with terrific squalls quickly following each other. Wind changing, (except she is on line of progression) and sea becoming cross and dangerous. (b) Barometer rising. Wind abating and sky clearing, but sea still confused and dangerous.

Q. 6.—Describe the track usually taken by cyclones in the Bay of Bengal, and state the seasons of the year in which they most frequently occur in that region.

A.—In this region storms take different tracks, those in the lower parts of the Bay going to the westward, while in the upper portion they generally travel N.N.W. The seasons are at the change of Monsoons ; April, May ; Sept, Oct., also in Nov., the two latter being worst months.

1.—N. Hemisphere. 8 points to right.

2.—Wind hauling to right, ship in right hand side. Look at No. 6, average track N.N.W., but change of wind shews going North ; corresponding diagram will shew ship as almost out of dangerous quadrant. By sailing as directed she will improve the weather, and perhaps get a fair wind for Calcutta, only watching the storm does not recurve to N.E.

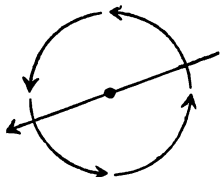
## No. IV.

Q. 1.—The direction of the wind in a cyclone being West, state the probable bearing of its centre from the ship in the Northern Hemisphere.

A.—About North.

Q. 2.—And suppose that the wind during the passage of the same cyclone were found to change toward the S.W., what would be the ship's position with reference to the line of progression of the centre of the cyclone; and what action would you take?

A.—The ship would be in the left hand side of the line of progression. I would run her with the wind on the starboard quarter until in a safe position, and then, if necessary, heave her to on the port tack. I would expect here to find a heavy cross sea.



3. }  
4. } Questions and answers same as in other papers.  
5. }

Q. 6.—Describe the track usually taken by cyclones in the China Sea; and state the seasons of the year in which they most frequently occur in that region?

A.—In this region storms generally travel W.S.W. or W.N.W., towards the Chinese coast. They occur between July and November, September and October being worst months.

2.—Ship is in the S.E. part of the typhoon, and in a hinder quadrant. She should be kept well out to the S.E. to avoid the terrible sea of the wake.

## CONCLUSION.

The rules and examples given should be sufficient for the purpose intended, but in order to add to the completeness of the work, the subjoined extract from the official "*Barometer Manual*" is appended. It comprises rules for a ship which has been lying-to, awaiting the development of a tropical cyclone, whether to remain so or not, and for the tack on which to put her when her place in the storm has been ascertained.

N. hemisphere.—If in the right-hand semicircle, heave-to on the starboard tack. If in the left-hand semicircle, run, keeping the wind, if possible, on the starboard quarter; and when the barometer rises, if necessary to keep the ship from going too far from the proper course, heave-to on the port tack.

S. hemisphere.—If in the right-hand semicircle, run, keeping the wind, if possible, on the port quarter, and when the barometer rises, if necessary to keep the ship from going too far from the proper course, heave-to on the starboard tack. If in the left-hand semicircle, heave-to on the port tack.

Both hemispheres.—When the ship lies in the direct line of advance of the storm \* \* \* the most dangerous of all—run. And in all cases act so as to increase as soon as possible the distance from the centre; bearing in mind that the whole storm field is advancing."

The above is from the latest and most authoritative work on the subject (issued after this was in the press), and is designed to suit either circular, spiral, or incurving storms. It will be noticed that the only difference between these rules and those given by the writer are, that where the "*Manual*" calls a whole semicircle dangerous, the "*Catechism*" so terms only a quadrant;

also that where the former recommends at once heaving-to in the dangerous side, the latter advises trying to increase the distance from the centre prior to doing so. It is very satisfactory to the writer to thus find his precepts corroborated by such high authority.

FINIS.











